Numeracy, Financial Literacy, and Investment Behaviors

UNDERGRADUATE RESEARCH THESIS

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Abstract

Past research has established the connections linking augmented financial literacy and objective numeracy to better-informed investment decisions. However, no known research has examined the independent predictive power of numeric competencies (i.e., objective numeracy, subjective numeracy, symbolic-number mapping) and financial literacy on investment behaviors, and it is unclear which skills may matter most. In an online study, participants (N=235) completed a test of general mathematical ability (i.e., objective numeracy), symbolic number-mapping, financial knowledge, and indicated their perceived mathematical ability and preference for numbers (i.e., subjective numeracy). To assess investment behaviors, participants completed a retirement savings game (Koehler et al. 2015) and answered a variety of questions related to personal investment decisions (e.g., "How much do you invest in stocks?"). We hypothesized that greater financial knowledge and greater numeric competencies would predict greater total retirement savings in the savings game. Additionally, we predicted that individuals with greater numeric competencies and greater financial knowledge would report more active engagement in investment activities (e.g., stocks, bonds, mutual funds).

Results indicated that financial literacy and numeric competencies were correlated with investment decisions and behaviors in various ways. Specifically, higher vs. lower financial literacy predicted more active participation in investments, longer years of investment experience, preference for riskier investment options such as stocks over bonds, treasury bills, bank savings and commodities. Additionally, individuals with higher vs. lower financial literacy scores were more likely to own retirement accounts, and they were stauncher about their investment beliefs. Inconsistent with hypotheses, higher vs. lower objective numeracy (ONS) was not predictive of many self-reported investment behaviors and was negatively correlated to

risk taking in life. Results also indicated that greater subjective numeracy (SNS) was positively correlated to risk taking in general in life, but was not correlated to risk taking in investments. Higher SNS was also associated to owning a larger variety of investment compositions. The retirement savings game yielded interesting results as well. Consistent with hypotheses, individuals with higher vs. lower financial literacy and higher vs. lower ONS had more savings at the retirement stage. Generally speaking, greater financial literacy and objective numeracy were shown to be positively correlated to a variety of positive investment traits and better savings behaviors in retirement game. Results suggest that efforts to improve financial literacy and objective numeracy may help improve investment decisions, however future experimental research is needed.

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Introduction

The 2008 financial crisis produced many far reaching tragic consequences. Significant numbers of individual investors, families, corporations were severely devastated. 8.8 million jobs were lost, and $19.2 trillion vanished (The Financial Crisis Response, 2012). Since then, improving investment decision making to better shield investors from unpredictable forces has become an imperative task for finance professionals, educators, and governments. With the rapid development of investment awareness and soaring attention to investment decisions, the mystery behind enhanced financial behaviors further tempts researchers to unveil its secret. The purpose of this research was to examine the importance of numeric competencies and financial literacy in individuals' investment decisions and outcomes. This research could serve as a stepping stone for future experimental research on ways to advance individuals' investment decisions.

Financial literacy is defined as one's knowledge of key financial concepts and the ability to manage personal finances through appropriate short-term decision-making and reasonable, long-term financial planning (Fernandes, Lynch, & Netemeyer, 2014). Past research has established the relation between augmented financial literacy and facilitated investment decisions. Specifically, individuals with greater financial literacy have enhanced awareness of investing, higher risk tolerance, and more active engagement in investment activities such as in the form of stocks, bonds, mutual funds etc. (Allgood & Walstad, 2016). However, this study did not assess numeracy and it remains unclear if these associations are due to greater financial literacy, greater numeric competencies, or both.

Numeric competencies may also play a significant role on investment decisions and there are multiple ways to be highly numerate. The most commonly studied numeric competence is

objective numeracy. Objective numeracy is defined as the ability to understand and use probabilistic and mathematical concepts and it is measured with a math (Peters, 2012; Reyna, Nelson, Han, & Dieckmann, 2009). Past research has demonstrated that objective numeracy is related to performing number comparison and calculations in judgments and decisions (Peters et al., 2006; Peters & Bjalkebring, 2015). Many studies suggest objective numeracy skills matter to judgments and decisions in important ways. For example, prior studies have found that more objectively-numerate individuals tend to be less susceptible to "framing effects" and tend to draw stronger and more precise meaning from numbers and numerical comparisons (Peters et al., 2006). In the field of investments where numbers are of great significance, calculation skills may play a crucial rule in affecting one's investment performance. For example, the estimations of stock price based on available information requires calculations at various levels. Additionally, prior research examining the importance of objective numeracy and individual wealth has found that individuals with greater objective numeracy tend to accumulate more wealth, hold more variable, diversified financial assets and know more about their financial decisions (Banks & Oldfield, 2007).

The second numeric competency is subjective numeracy, which is defined as an individual's subjective rating of perceived numeric abilities and preferences with numbers (Peters & Bjalkebring, 2015). In Peters & Bjalkebring's research (2015), subjective numeracy was found to be related to greater confidence and/or motivation, as well as more positive emotional reactions to numbers. An individual's subjective numeracy and emotional reactions to numbers may directly impact his/her investment behaviors and decisions. For example, in a fast-paced and highly fluctuating stock market, an investors' confidence in his/her numeric abilities may be particularly beneficial when an investor faces a situation where a quick, tough investment

decision needs to be made. Additionally, individuals with greater subjective numeracy may be more motivated to take action with their personal investments (e.g., actively saving for retirement) or to seek out different investment options. Therefore, we would like to further explore if greater subjective numeracy would be conducive to more informed investment behaviors. No published research has examined the relation of subjective numeracy to investment behaviors and outcomes.

The last numeric competency, symbolic-number mapping (SMAP), is thought to tap into internal representations of numeric magnitude and the mapping of symbolic numbers onto those representations (Peters & Bjalkebring, 2015). Research suggests that mapping abilities can provide a compensatory skill with numbers that supports good judgements and decisions when the individual lacks the time or motivation to formally calculate numbers. For example, individuals with higher SMAP may be better at estimating totals of numbers and more accurate perceptive on numeric information. In addition, greater SMAP was found to be positively associated with better memory for numbers (Peters & Bjalkebring, 2015). This advanced memory may allow investors easy access to past security prices, which may become a very important factor when making investment decisions. Also, previous research has found that lower vs. higher SMAP was associated with greater risk aversion (Peters & Schley, 2014). In the process of investment decision making, excellent estimation of future returns, cost-benefit analysis, memory for numbers and risk tolerance are all very important. Thus, we would also like to explore the relation between SMAP and enhanced investment behaviors.

Research Objective

This research explored the relations between numeric competencies, financial literacy and investment decisions. No known research has examined the independent predictive power of objective numeracy, subjective numeracy, symbolic-number mapping, and financial literacy on investment behaviors. Assessing which of these variables were important in predicting investment behaviors could help guide future experimental research on ways to improve individuals' investment decisions and outcomes.

We conducted an online study on Amazon Mechanical Turk to collect individuals' self-reported investment behaviors and decisions. Given that we did not expect all participants to be active investors, we also had participants play a simulated retirement savings game developed by previous researchers (Koehler et al., 2014). In this game, participants made decisions over the course of a life cycle in regards to how much of their income to consume immediately and how much to save for a later retirement phase in which no income was generated. In addition to these tasks, we also assessed individuals' financial literacy, objective numeracy, subjective numeracy, and symbolic number-mapping abilities using common measures in the judgment and decision-making literature (Houts & Knoll, 2012; Peters & Bjalkebring, 2015).

Hypotheses

For the Investment Survey Questions

We predicted that individuals with greater financial literacy and greater skills in all three numeric competencies would be more likely to: 1) take risks in life in general, 2) invest, 3) take risks in investments, 4) have longer years of investment experience, 5) manage money on their own, 6) own riskier compositions such as stocks over bonds, treasury bills and bank savings, 7)

own a retirement account, 8) have a plan for retirement, and 9) stay confident in their investment beliefs when facings unexpected sharp changes in their investments.

For the Retirement Savings Game

We predicted that individuals with greater financial literacy and greater skills in all three numeric competencies would be more likely to: 1) have more savings at the retirement stage on average, and 2) have more smoothed out spending across all periods on average.

Additionally, we predicted that individuals with greater financial literacy and greater objective numeracy would be more likely to: 3) have more savings at the retirement stage when facing a long retirement condition vs. a short retirement condition, 4) have more savings at the retirement stage when facing a high expense variance condition vs. a low expense variance condition, 5) have more smoothed out spending across all periods when facing a long retirement condition vs. a short retirement condition, and 6) have more smoothed out spending across all periods when facing a high expense variance condition vs. a low expense variance condition.

Methodology

Data Collection

Sample:

In order to recruit a diverse sample, Amazon Mechanical Turk was used to collect data. Due to the drastic difference among the investment environments all over the world, the participants were confined to the United States. We collected data from 235 adult participants (mean age = 34 years old, 62% male).

Procedure:

Participants were recruited through Amazon's Mechanical Turk website to complete materials using Qualtrics research software. Participants completed several individual difference measures (discussed below) and provided basic demographic information. Participants also completed a series of investment questions and an online savings game. Participants completed the survey tasks in the following order: SNS, the retirement savings game, investment questions, SMAP, ONS, financial literacy and demographics questions. All measures and survey questions are available in the appendix.

Measurement/Instrumentation:

Financial literacy:

Participants completed a 10-item-scale designed by Houts & Knoll (2012) to test their knowledge and understanding of financial concepts. For example, "Assume a friend inherits $10,000 today and his sibling inherits $10,000 but 3 years from now. Who is richer today because of the inheritance?". These questions were retrieved and cited from previous research studies of financial literacy and can be reused to serve the same test purpose. Participants' financial literacy scores were determined based on the total number of correct answers provided, ranging from 0-10.

Objective numeracy:

Participants completed eight probabilistic and mathematic items, composing of questions such as, "if the chance of winning the lottery is 0.02%, how many people would be expected to win out of 1000," (Weller, Dieckmann, Tusler, Mertz, Burns, & Peters, 2015). Based on the number of correct and incorrect answers, participants received a total ONS score ranging from 0-8.

Subjective numeracy:

Participants' subjective numeracy was assessed using the Subjective Numeracy Scale (SNS), which is a self-reported measure of one's own numeric ability and a preference for numbers. SNS ranges from 1-6, and includes questions such as, "how often do you find numerical information useful?" (Fagerlin et al., 2007).

SMAP:

Lastly, to measure an individual's Symbolic Mapping Abilities, an online version of the methods utilized by Peters and Bjalkebring (2015) was used. Participants were presented with scale bars anchored at 0 and 1,000 and were told to slide the scale bar to indicate where they believed the number belonged on the line. On each page, they were presented a single number (2, 5, 18, 56, 163, 725 etc.; presented in random order) and would indicate the number's position on the line. Consistent with Peters & Bjalkebring (2015), SMAP scores were calculated by taking the absolute value of the difference between each number presented to participants and the number participants located on the scale bar. Next, we took the average of the differences for each participant and log transformed it. Finally, we multiplied -1 to each average result to ensure that higher number indicated better SMAP abilities. Thus, SMAP scores were always negative and the closer it was to 0, the better a participant was at SMAP.

Investment Questions:

Participants were asked questions related to their investment decisions and investment awareness. Example investment questions include: "Do you invest?"; "When did you start investing?" *Less than a year ago*, to *More than twenty years ago*; "Do you have a retirement account?"; "How willing are you to take risks with your investments?" *Not at all willing*, to *Very willing*. Participants were also asked how much they invested in stocks, bonds, treasury bills,

bank savings. Some of these questions were taken from previous research on investments (e.g., Allgood, 2016), others were developed for this survey.

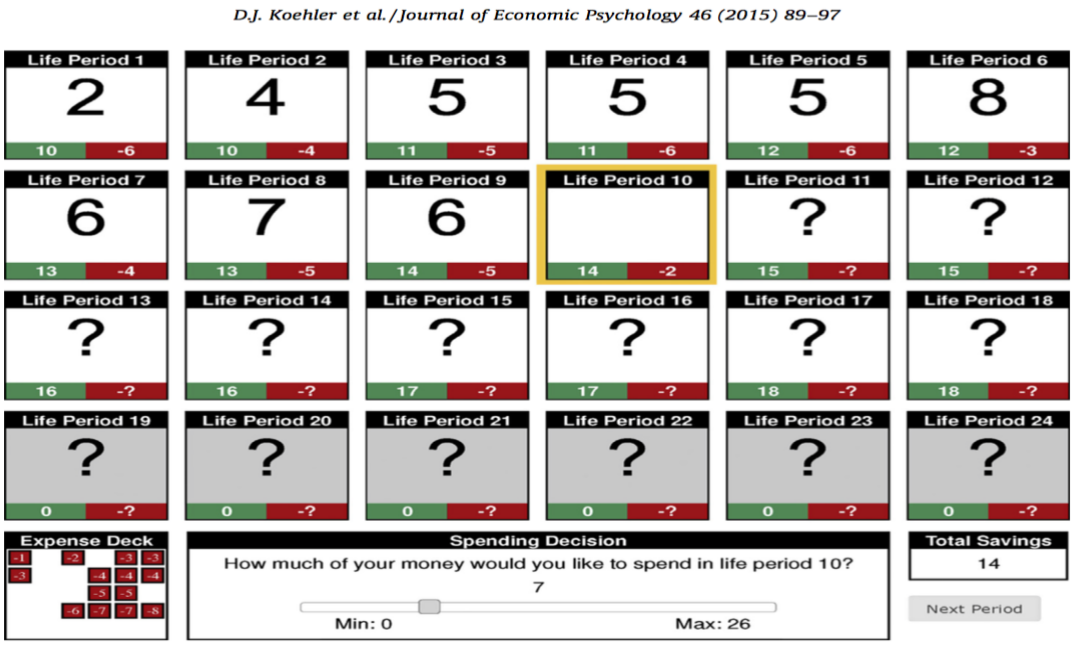
In addition, attributes such as investment confidence were also assessed in the survey. Participants were given two hypothetical scenarios in which his/her investments underwent a sharp, unexpected change in value and were told to choose the actions they may likely take under such situation. Specifically, participants were told they purchased 1000 shares of stock from a prominent and promising company, at the price of $100 per share. In one scenario, the price *dropped* to $50 per share a month later. In the second scenario, the price *increased* to $150 per share a month later. In both scenarios, participants indicated whether they would sell all the shares, sell some of the shares, buy more shares, or do nothing.

Each survey question was treated as a dependent variable in our study and was designed to reflect certain distinctive investment-related traits. The full survey questions can be found in the appendix.

Retirement Savings Game:

Participants completed a simulated retirement-savings task designed by previous researchers (Koehler et al., 2014). Participants made decisions over the course of a life cycle, in regard to how much of their income to consume immediately and how much to save for a later retirement phase in which no income was generated. The savings task was developed to be readily understood and performed online by members of a diverse participant population. Instead of 8 rounds as conducted in Dr. Koehler's study, we reduced the life cycles to 4 rounds due to time limitations. In each round (life cycle), participants made decisions about how much to save for each period. One period was approximately 3 years. Participants were told to imagine the

game as a real life cycle and all units were in thousand dollars. A screenshot of the game is attached below.



As indicated in the picture, current period was highlighted in yellow. Numbers in green background indicated income for each period, and numbers in red background indicated expenses (i.e., the money that had to be consumed for each period). Expenses for future periods were unknown as indicated by question marks. However, the expense deck indicated remaining expenses that would be encountered in the future periods, by which participants could plan how much money to spend for each period accordingly. Discretionary spending for each round was recorded as big black numbers in the box. The grey background indicated the retirement phase where income became zero. Total savings were indicated in the box in the right corner. On each period, participants decided how much money they wanted to spend given all information by using the slider at the bottom ranging from 0 to money they have saved up to now.

There were two conditions for this game. One condition was retirement length. During the 4 rounds, participants went through two rounds with short retirement length and two with long retirement length. In the short retirement condition, retirement started at period 19, as depicted in the screen shot. In the long retirement condition, retirement started at period 13. The second condition was expense variance. During the 4 rounds, participants encountered two rounds with a high expense variance and two with a low expense variance. The two conditions create 4 unique rounds for each participant: 1) Long Retirement, High Expense Variance 2) Long Retirement, Low Expense Variance 3) Short Retirement, High Expense Variance 4) Short Retirement, Low Expense Variance. In each round, savings and discretionary spending for each period was recorded. We were interested in how much participants saved at the retirement stage and at the end of the game based on participants' numeric competencies and financial literacy. We were also interested in how smoothed out participants' discretionary spending was throughout the game based on their numeric competencies and financial literacy.

Data Analysis

Out of the 235 participants, 5 participants were excluded from data analysis because they did not finish the survey questions. Before diving into further analysis for the survey questions and the investment game respectively, we ran descriptive and correlations analyses among the independent variables. Descriptive data for each scale are shown in Table 1.

Table 1. Scale descriptive data (N=230)

Variable	Possible Range	Mean(SE)	Std Dev	Min	Max
Financial Literacy	0-10	6.85	2.06	1.00	10.00
ONS	0-8	5.10	1.89	0.00	8.00
SMap	<0	-1.57	0.27	-2.72	-1.08
SNS	0-6	4.81	0.74	2.13	6.00

Our independent variables were correlated as expected. Higher vs. lower ONS was associated with greater self-reported SNS ($r=.31$, $p<.0001$). Higher vs. lower financial literacy was correlated to higher ONS ($r=.61$, $p<.0001$), higher SNS ($r=.29$, $p<.0001$), and higher SMAP ($r=.43$, $p<.0001$). Additionally, higher vs. lower SMAP scores were associated with greater ONS ($r=.50$, $p<.0001$) and greater SNS ($r=.18$, $p=.007$).

Results

Part I: Analysis of the investment game

To examine participants' investment behaviors and preferences, we conducted multiple regressions and logistic regressions in SPSS for each of the investment survey questions using ONS, SNS, SMAP, Financial literacy, age, gender, years of education and household income as independent predictors. To obtain a final model for each of the dependent variables, non-significant predictors (defined as $p>.05$) were removed one at a time using backward elimination method, and the final model is shown below.

Question 1: How willing are you to take risks in your life?

Hypothesis: Individuals with higher vs. lower financial literacy and higher vs. lower numeric competencies would be more willing to take risks in life in general

Initial Model:

- General Risk Preference= SNS + ONS + SMAP + Financial Literacy + Age + Gender + Years of Education+ Household Income

Table 2. Linear regression results for Investment Question 1

	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	3.75	0.54		6.95	0.00
SNS	0.25	0.12	0.15	2.17	**0.03**
ONS	-0.13	0.05	-0.19	-2.37	**0.02**
Financial literacy	-0.08	0.05	-0.14	-1.70	0.09

Note: Model R^2 = .082, df (3,229), F = 6.69 (p<.0001). Significant predictors are in bold for emphasis

As shown by the regression output, SNS and ONS were the remaining significant predictors (p<0.05). Results indicated that participants who were higher vs. lower in SNS (B= 0.25, p<.05), and those who were lower vs. higher in ONS (B= -0.13, p<.05), were more likely to take risk in life in general. There were no significant differences in risk preference based on Financial literacy and SMAP.

Question 2: Do you invest?

Hypothesis: Individuals with higher vs. lower financial literacy and higher vs. lower numeric competencies would be more likely to invest

Initial Model:

- Investment participation= SNS + ONS + SMAP + Financial Literacy + Age + Gender + Years of Education+ Household Income

Table 3. Logistic regression results for Investment Question 2

	B	S.E.	Wald	df	Sig.	Exp(B)
SNS	0.82	0.22	14.25	1	**0.000**	2.28
SMAP	-1.70	0.63	7.33	1	**0.007**	0.18
Financial literacy	0.16	0.08	3.90	1	**0.048**	1.17
Constant	-7.45	1.70	19.15	1	0	0.00

Note: Model R^2 = .111, df (3,229), Significant predictors are in bold for emphasis

As shown by the logistic regression output, SNS, SMAP and Financial Literacy were the remaining significant predictors ($p<0.05$). Results indicated that participants who were higher vs. lower in SNS (B= 0.82, $p<.05$), those who were lower vs. higher in SMAP (B= -0.13, $p<.05$), and those who were higher vs. lower in Financial literacy (B= 0.16, $p<.05$), were more likely to invest. There were no significant differences in investment participation based on ONS.

Question 3: How willing are you to take risks in your investments?

Hypothesis: Individuals with higher vs. lower financial literacy and higher vs. lower numeric competencies would be more likely to take risks in investments

Initial Model:

- Investment Risk Preference= SNS + ONS + SMAP + Financial Literacy + Age + Gender + Years of Education+ Household Income

Table 4. Linear regression results for Investment Question 3

	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	3.75	0.54		6.95	0
SNS	0.02	0.19	0.01	0.08	0.935
SMAP	0.44	0.45	0.11	0.98	0.331
ONS	-0.10	0.08	-0.17	-1.30	0.206
Financial literacy	-0.03	0.07	-0.06	-0.46	0.646
Age	-0.02	0.01	-0.13	-1.4	0.167
Gender	0.12	0.23	0.05	0.54	0.593
Years of Education	0.03	0.03	0.07	0.74	0.459
Household Income	0.09	0.07	0.12	1.3	0.195

Note: Model R^2 = .082, df (3,126), F = 6.69 (p<.0001). Significant predictors are in bold for emphasis

As indicated by the regression output, no variables were significant predictors of willingness to take risks in investments. Therefore, in conclusion, there were no significant differences in risk preference in investments based on ONS, SNS, SMAP and Financial Literacy.

Question 4: When did you start investing?

Hypothesis: Individuals with higher vs. lower financial literacy and higher vs. lower numeric competencies would have longer years of investment experience

Initial Model:

- Investment participation= SNS + ONS + SMAP + Financial Literacy + Age + Gender + Years of Education+ Household Income

Table 5. Linear regression results for Investment Question 4

	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
Constant	-0.18	0.31		-0.59	0.556
Age	0.06	0.01	0.59	8.50	**0.000**
Household income	0.14	0.05	0.21	2.99	**0.003**

Note: Model R^2 = .42, df (2,126), F = 44.34 (p<.0001). Significant predictors are in bold for emphasis

As indicated by the regression output, age and household income were statistically significant (p<.05). Those who were older vs. younger and those with higher vs. lower household income had more years of investment experience. Therefore, in conclusion, there were no significant differences in years of investment experience based on ONS, SNS, SMAP and Financial Literacy.

Question 5: Who manages your money?

Hypothesis: Individuals with higher vs. lower financial literacy and higher vs. lower numeric competencies would be more likely to manage money on their own

For this question, we scored any answer that included "I manage money myself" as 1, and the rest were all scored as 0. In this regard, this question became binary and a logistic regression was conducted.

Initial Model:

- Self-management of money= SNS + ONS + SMAP + Financial Literacy + Age + Gender + Years of Education+ Household Income

Table 6. Logistic regression results for Investment Question 5

	B	S.E.	Wald	df	Sig.	Exp(B)
SMAP	2.74	0.77	12.59	1	**0.000**	15.46
Household Income	-0.39	0.16	6.22	1	**0.013**	0.68
Constant	7.24	1.61	20.03	1	0.000	1393.00

Note: Model R^2 = .14, df (2,126), Significant predictors are in bold for emphasis

As shown by the regression output, SMAP and household income were statistically significant ($p<.05$) predictors of managing money. Those with a higher vs. lower SMAP and higher vs. lower household income were more likely to manage money themselves. There were no significant differences in self-management of money based on ONS, SNS, and Financial Literacy.

Question 6: How much do you invest in stocks?

Hypothesis: Individuals with higher vs. lower financial literacy and higher vs. lower numeric competencies would be more likely to own stocks

Initial Model:

- Stock Investment= SNS + ONS + SMAP + Financial Literacy + Age + Gender + Years of Education+ Household Income

Table 7. Linear regression results for Investment Question 6

	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	2.23	0.30		7.50	0
ONS	-0.11	0.06	-0.21	-1.90	0.060
Financial literacy	0.16	0.05	0.37	3.28	**0.001**

Note: Model R^2 = .31, df (2,126), F = 8.819 ($p<.0001$). Significant predictors are in bold for emphasis

As indicated by the regression output, financial literacy was statistically significant ($p<.05$). ONS was marginally significant ($p<0.10$). In conclusion, the result showed that those with a higher vs. lower financial literacy and those that were lower vs. higher in ONS tended to invest more in stocks. There were no significant differences in how much to invest in stocks based on SMAP and SNS.

Question 7: How much do you invest in bonds?

Hypothesis: Individuals with higher vs. lower financial literacy and higher vs. lower numeric competencies would be more likely to own bonds

Initial Model:

- Bond Investment= SNS + ONS + SMAP + Financial Literacy + Age + Gender + Years of Education+ Household Income

Table 8. Linear regression results for Investment Question 7

	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	0.24	0.61		0.39	0.697
Financial literacy	-0.11	0.04	-0.28	-2.85	**0.005**
SMAP	-0.91	0.26	-0.32	-3.47	**0.001**
Age	0.01	0.01	0.16	1.99	**0.049**
Gender	0.29	0.15	0.16	1.98	**0.050**
Household income	0.08	0.04	0.14	1.76	0.081

Note: Model $R^2 = .27$, df (5,126), $F = 8.819$ ($p<.0001$). Significant predictors are in bold for emphasis

As indicated by the regression output, SMAP, financial literacy, age, and gender, were statistically significant ($p<.05$). Household income was marginally significant ($p<0.10$). Those

with a higher vs. lower financial literacy and higher vs. lower household income tended to invest less in bonds. Those who were older and those with higher vs. lower household income were more likely to own more bonds. There were no significant differences in bond investments based on ONS and SNS.

To assess the participants' preference on stocks vs. bonds based on our predictors, we took the difference of scores between stocks and bonds, and regressed it on financial literacy, ONS, SNS, and SMAP. The regression output suggested that financial literacy ($p<0.0000$) was statistically significant. Those with a higher vs. lower financial literacy are more likely to invest in stocks than bonds.

Table 9. Linear regression results for Stocks vs. Bonds

	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	-0.79	0.40		-1.956	0.053
Financial literacy	0.23	0.05	0.36	4.315	**0.000**

Note: Model $R^2 = .13$, df (1,123), $F = 18.620$ ($p<.0001$). Significant predictors are in bold for emphasis

Question 8: How much do you invest in treasury bills?

Hypothesis: Individuals with higher vs. lower financial literacy and higher vs. lower numeric competencies would be more likely to own treasury bills

Initial Model:

- TB Investment= SNS + ONS + SMAP + Financial Literacy + Age + Gender + Years of Education+ Household Income

Table 11. Linear regression results for Investment Question 8

	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	-0.81	0.79		-1.03	0.307
Financial literacy	-0.10	0.03	-0.28	-3.05	**0.003**
SNS	0.22	0.11	0.16	1.97	0.051
SMAP	-0.76	0.24	-0.29	-3.22	**0.002**
Years of Education	0.05	0.02	0.22	2.77	0.006

Note: Model R^2 = .27, df (4,124), F = 11.17 (p<.0001). Significant predictors are in bold for emphasis

As indicated by the regression output, financial literacy, SMAP and years of education were statistically significant (defined as p<.05). SNS was marginally significant (p=0.05). In conclusion, the result showed that those with a higher vs. lower financial literacy and those who had a higher vs. lower SMAP score tended to invest less in treasury bills. Participants with higher vs. lower SNS and more years of education invested more in treasury bills. There were no significant differences in how much to invest in treasury bills based on ONS.

To assess the participants' preference on stocks vs. treasury bills based on our predictors, we took the difference of scores between stocks and treasury bills, and regressed it on financial literacy, ONS, SNS, and SMAP. The regression output suggested that financial literacy (p<0.0000) was statistically significant. Those with a higher vs. lower financial literacy are more likely to invest in stocks than treasury bills

Table 12. Linear regression results for Stocks vs Treasury Bills

	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	-0.47	0.35		-1.346	0.181
Financial Literacy	0.24	0.05	0.41	4.96	**0.000**

Note: Model R^2 = .11, df (1,121), F = 7,45 (p=.001). Significant predictors are in bold for emphasis

Question 9: How much do you invest in bank savings?

Hypothesis: Individuals with higher vs. lower financial literacy and higher vs. lower numeric competencies would be more likely to own bank savings

Initial Model:

- Bank savings= SNS + ONS + SMAP + Financial Literacy + Age + Gender + Years of Education+ Household Income

Table 13. Linear regression results for Investment Question 9

	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	0.50	0.90		0.56	0.58
Financial literacy	-0.08	0.04	-0.21	-2.11	**0.037**
SNS	0.28	0.14	0.18	2.08	**0.040**
SMAP	-0.64	0.29	-0.22	-2.21	**0.029**

Note: Model R^2 = .084, df (3,124), F = 7.24 (p<.0001). Significant predictors are in bold for emphasis

As indicated by the regression output, financial literacy, SMAP and SNS were statistically significant (defined as p<.05). In conclusion, the results showed that participants with a higher vs. lower financial literacy and those that had a higher vs. lower SMAP scores tended to invest less in bank savings. Participants with higher SNS invested more in bank

savings. There were no significant differences in how much to invest in treasury bills based on ONS.

To assess the participants' preference on stocks vs. bank savings based on our predictors, we took the difference of scores between stocks and bank savings, and regressed it on financial literacy, ONS, SNS, and SMAP. The regression output suggested that financial literacy ($p<0.0000$) was statistically significant. Participants with a higher vs. lower financial literacy are more likely to invest in stocks than bank savings.

Table 14. Linear regression results for stocks vs. bank savings

	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	-0.83	0.42		-1.992	0.049
Financial literacy	0.20	0.06	0.31	3.608	**0.000**

Note: Model $R^2 = .098$, df (1,121), $F = 13.016$ ($p<.0001$). Significant predictors are in bold for emphasis

Question 10: Do you have a retirement account?

Hypothesis: Individuals with higher vs. lower financial literacy and higher vs. lower numeric competencies would be more likely to own retirement accounts

Initial Model:

- Owning retirement account= SNS + ONS + SMAP + Financial Literacy + Age + Gender + Years of Education+ Household Income

Table 15. Linear regression results for Investment Question 10

	B	S.E.	Wald	df	Sig.	Exp(B)
Financial literacy	0.05	0.09	0.29	1	0.589	1.05
SMAP	-1.60	0.60	7.12	1	**0.008**	0.20
Age	0.06	0.02	12.71	1	**0.000**	1.06
Household Income	0.40	0.10	16.99	1	**0.000**	1.50
Constant	-7.04	1.45	23.45	1	**0.000**	0.00

Note: Model R^2 = .31, df (4,227). Significant predictors are in bold for emphasis

As indicated by the regression output, SMAP, age, and household income were statistically significant (defined as p<.05). In conclusion, the result showed that participants with lower vs. higher SMAP, older age and more household income were more likely to own a retirement account. There were no significant differences in owning a retirement account based on financial literacy, ONS, and SNS.

Question 11: Have you ever tried to figure out how much you need to save for retirement?

Hypothesis: Individuals with higher vs. lower financial literacy and higher vs. lower numeric competencies would be more likely to have a retirement saving plan

Initial Model:

- Retirement saving plan= SNS + ONS + SMAP + Financial Literacy + Age + Gender + Years of Education+ Household Income

Table 16. Linear regression results for Investment Question 11

	B	S.E.	Wald	df	Sig.	Exp(B)
SMAP	-1.57	0.87	3.31	1	0.069	0.21
Age	0.05	0.03	3.56	1	0.059	1.05
Constant	-3.94	1.81	4.74	1	**0.029**	0.02

Note: Model R^2 =0.21, df (2, 84). Significant predictors are in bold for emphasis

As indicated by the regression output, SMAP (p=0.069) and age (p=0.059) were marginally significant (defined as p<.05). In conclusion, the result showed that participants with higher vs. lower SMAP were less likely to have tried to figure out how much money to save for retirement. There were no significant differences in the likelihood of having figured out a retirement plan based on ONS, SNS, and financial literacy.

Question 12: In preparing for your retirement, please select all the people who you asked or plan to ask for financial advice?

Hypothesis: Individuals with higher vs. lower financial literacy and higher vs. lower numeric competencies would be more likely to ask for financial advice

For this question, we scored any answer that included asking for advice as 1 and not asking for advice as 0. In this regard, this question became binary and a logistic regression was conducted.

Initial Model:

- Ask for advice= SNS + ONS + SMAP + Financial Literacy + Age + Gender + Years of Education+ Household Income

Table 17. Linear regression results for Investment Question 12

	B	S.E.	Wald	df	Sig.	Exp(B)
ONS	-0.13	0.21	0.37	1	0.541	0.88
Financial literacy	-0.09	0.18	0.26	1	0.611	0.91
SNS	0.03	0.48	0.00	1	0.958	1.03
SMAP Score	-0.39	1.25	0.10	1	0.753	0.68
Age	0.02	0.03	0.40	1	0.528	1.02
Gender	-0.12	0.60	0.04	1	0.84	0.89
Years of Education	0.07	0.10	0.55	1	0.458	1.08
Household Income	0.30	0.18	2.57	1	0.109	1.34

Note: Model R^2 =0.36., df (8, 84). Significant predictors are in bold for emphasis

As indicated by the regression output, no variable was a statistically significant predictor of asking for advice vs. not asking for advice. In conclusion, there were no significant differences in the likelihood of asking for financial advice to prepare for retirement based ONS, SNS, SMAP and financial literacy.

Question 13: If you purchased 1000 shares of stock from company A which you believed was a prominent and promising company, at the price of $100 per share, and a month later the price dropped to $50 per share, which of the following would you most likely do?

Hypothesis: Individuals with higher vs. lower financial literacy and higher vs. lower numeric competencies would be less likely to sell the stocks

We treated this question as a binary question as well. The answers that included "sell" were scored 0, and everything else was scored as 1. Therefore, a logistic regression was conducted for this question.

Initial Model:

- Unwillingness to sell= SNS + ONS + SMAP + Financial Literacy + Age + Gender + Years of Education+ Household Income

Table 18. Linear regression results for Investment Question 13

	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
ONS	0.17	0.10	2.83	1	0.092
Financial literacy	0.30	0.09	10.62	1	**0.001**
Constant	-2.07	0.55	14.34	1	0

Note: Model R^2 = .23, df (2, 226), F = 8.12 (p<.0001). Significant predictors are in bold for emphasis

As indicated by the regression output, financial literacy (p=0.001) was discovered to be statistically significant, and ONS was marginally significant (p=0.09). In conclusion, participants

with higher vs. lower ONS and higher vs. lower financial literacy were less likely to sell their stocks, which in a sense demonstrated staunch investment belief in the face of a sudden, sharp change of outlook. There were no significant differences in the behaviors based on SNS and SMAP.

Question 14: If you purchased 1000 shares of stock from company A which you believed was a prominent and promising company, at the price of $100 per share, and a month later the price increased to $150 per share, which of the following would you most likely do?

Hypothesis: Individuals with higher vs. lower financial literacy and higher vs. lower numeric competencies would be less likely to buy more stocks

We treated this question as a binary question as well. The answers that included "buy" were scored 0, and everything else was scored as 1. Therefore, a logistic regression was conducted for this question.

Initial Model:

- Unwillingness to buy= SNS + ONS + SMAP + Financial Literacy + Age + Gender + Years of Education+ Household Income

Table 19. Linear regression results for Investment Question 14

	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
ONS	0.42	0.13	9.90	1	**0.002**
Financial literacy	0.24	0.12	4.06	1	**0.044**
Constant	-1.70	0.64	6.77	1	0.009

Note: Model R^2 = .33, df (2,226), F = 11.42 (p<.0001). Significant predictors are in bold for emphasis

As shown by the regression output, financial literacy (p=0.044) and ONS (p=0.002) were found to be statistically significant predictors of unwillingness to buy more stock. In conclusion, participants with higher vs. lower ONS and higher vs. lower financial literacy were less likely to buy more stocks, which in a sense demonstrated staunch investment belief in the face of a sudden, sharp change of outlook. There were no significant differences in the behaviors based on SNS and SMAP.

Part II: Analysis for Investment Game

For the investment game, each participant's discretionary spending was recorded. There were primarily two dependent variables that we were concerned about with the investment game: savings at retirement and variance in spending. We were interested in how much participants saved at the retirement stage based on their numeric competencies and financial literacy. We were also interested in how smoothed out participants' discretionary spending was throughout the game based on their numeric competencies and financial literacy.

As a reminder, there were two conditions involved in this game, which are retirement length (short vs. long) and expense variance (high vs. low). First, we ran a mixed model ANOVA predicting savings at retirement to see if we replicated the condition effects found by the developers of the game. We managed to replicate the condition results found by Koehler and colleagues (Koehler et al., 2014). Specifically, participants saved more when facing a long retirement than they did when facing a short retirement. They also saved more when facing a high variance of expense than they did when facing a low expense variance. Having tested the validity of our data, we moved on to predicting participant's total savings at retirement (across all four rounds) based on differences in ONS, SNS, SMAP, and financial literacy.

Savings at Retirement

Hypothesis: Across all four rounds, individuals with higher vs. lower financial literacy and higher vs. lower objective numeracy would have more total savings at retirement

We averaged the money saved up to the retirement stage by 4 rounds for each participant. Then we regressed it on SNS, ONS, SMAP, financial literacy, age, gender, years of education and household income. The final regression model output is shown below.

Table 20. Linear regression results for Savings at Retirement

	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	79.63	8.65		9.204	0
Financial literacy	6.65	1.09	0.40	6.112	**0.000**
Gender	-7.52	4.33	-0.11	-1.738	0.084
Household Income	-2.367	1.299	-0.119	-1.822	0.070

Note: Model R^2 = .33, df (2,209), F = 11.42 (p<.0001). Significant predictors are in bold for emphasis. Gender (1= , 0=)

As shown from the table, financial literacy (B=6.651, p=0.000) was found to be positively predictive of more savings at the retirement stage across all four stages. Gender and household income were marginally significant (p= 0.084 and p=0.074, respectively). Therefore, results indicated that individuals with higher vs. lower financial literacy and those with less vs. more household income tended to have more savings at the retirement stage. Additionally, females (females were coded as 0 and males were coded as 1) had more savings at retirement than males.

Hypothesis: Individuals with higher vs. lower financial literacy and higher vs. lower objective numeracy would have more saving at retirement when facing long retirement rounds vs. short retirement rounds

Next, we tested how much money participants saved for the long retirement rounds relative to the short retirement rounds based on differences in ONS, SNS, SMAP, and financial literacy. To do so, we took the average money saved at retirement of the two long retirement rounds and the average money saved at retirement of the two short retirement rounds, and created a new variable, which was the difference of the two values. We regressed the new variable on ONS, SNS, financial literacy, age, gender, years of education of household income. The final regression model is shown below.

Table 21. Linear regression results for Saving Difference between Long and Short Retirement Length

	Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
	B		Beta		
(Constant)	27.73	5.97		4.644	0
ONS	2.32	1.08	0.15	2.149	**0.033**

Note: Model R^2 = .022, df (1,207), F = 4.62 (p=0.033). Significant predictors are in bold for emphasis

As shown by the table, ONS was the only predictor that was found statistically significant (p=0.033). This result suggested that the higher an individual is in ONS, the more he will save when facing a long retirement situation than facing a short retirement one. This demonstrated that individuals with higher ONS became more cautious when retirement was long, which entailed more years to come without receiving income. Higher-ONS individuals were sensitive to this retirement length and planned more appropriately than lower-OSN individuals.

Hypothesis: Individuals with higher vs. lower financial literacy and higher vs. lower objective numeracy would have more saving at retirement when facing high expense variance rounds vs. low expense variance rounds

Next, we tested how much money participants saved for high expense variance rounds relative to low expense variance rounds based on our predictor variables of interest. To do so, we took the average savings at retirement of the two high expense variance rounds and the average of savings at retirement of the two short retirement rounds, and created a new variable, which was the difference of the two values. We then regressed it on ONS, SNS, financial literacy, age, gender, years of education of household income. The final model regression model is shown below.

Table 22. Linear regression results for Saving Difference between High and Low Expense Variance

	Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
	B		Beta		
(Constant)	27.61	6.27		4.401	0
ONS	-2.89	1.13	-0.17	-2.549	**0.012**

Note: Model R^2 = .03, df (1,209), F = 6.5 (p=0.012). Significant predictors are in bold for emphasis

The result indicated that ONS was the only statistically significant predictor (p=0.012). Specifically, individuals with higher vs. lower ONS saved less when facing a high expense variance rounds than when facing a low expense variance rounds.

Spending Variance

Hypothesis: Individuals with higher vs. lower financial literacy and higher vs. lower objective numeracy would have more smoothed out spending across periods when facing long retirement rounds vs. short retirement rounds

Next, we tested the variability in participants' discretionary spending across all four rounds based on their financial literacy and numeric competencies. To do so, we calculated each participant's spending variance across all 24 periods and averaged it by 4 rounds. Then we regressed it on SNS, ONS, SMAP, financial literacy, age, gender, years of education and household income. The regression output is shown below.

Table 23. Linear regression results for spending variance

	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	40.11	7.90		5.08	0.000
ONS	-5.10	1.38	-0.25	-3.687	**0.000**
Gender	10.68	4.87	0.15	2.193	**0.029**

Note: Model R^2 = .074, df (2,209), F = 8.3 (p<.0001). Significant predictors are in bold for emphasis. Gender (1=, 0 =).

As indicated by the table, ONS (B=-5.095, p=0.000) and gender (B=10.680, p=0.029) were found to be significantly predictive of spending variance across all four rounds. Individuals with higher vs. lower ONS were more likely to smooth out their spending, which means they spent their money more consistently with a steady pace. Additionally, females (females were coded as 0 while male were coded as 1) had a more consistent spending pattern than males.

Next, we tested the difference in spending variance for long retirement rounds relative to high retirement rounds based on participants' financial literacy and numeric competencies. To do so, we took the variance of discretionary spending of the two long retirement rounds and

variance of discretionary spending of the two short retirement rounds, and created a new variable, which was the difference of the two values. We regressed the new variable on ONS, SNS, financial literacy, age, gender, years of education of household income. The final regression model is shown below.

Table 24. Linear regression results for Spending Variance between Long and Short Retirement Length

	Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
	B		Beta		
(Constant)	45.44	8.93		5.091	0
ONS	-6.14	1.61	-0.26	-3.806	**0.000**

Note: Model R^2 = .066, df (1,207), F = 14.48 (p<.0001). Significant predictors are in bold for emphasis

Results indicated that ONS was negatively correlated to high variance in discretionary spending, which meant that individuals with higher ONS tended to smooth out their spending more when facing a long retirement than facing a short retirement. This result showed that under a long retirement condition where there were more periods without income to come, participants with higher ONS became more precautious and consistent with their spending.

Hypothesis: Individuals with higher vs. lower financial literacy and higher vs. lower objective numeracy would have greater variability in spending during high expense variance rounds vs. low expense variance rounds

We hypothesized that when the expense variance condition changes, individuals with higher ONS and financial literacy would be better able to perceive it by roughly estimating the fluctuation of future expenses from the expense deck. Therefore, we predicted that participants with higher vs. lower financial literacy and higher vs. lower objective numeracy would have

more variable spending when high expense variance rounds vs. low expense variance rounds. In comparison, individuals with lower financial literacy and lower objective numeracy who would likely be insensitive to such change in expense condition.

We tested the difference in spending variance for high expense rounds relative to low expense rounds based on participants' financial literacy and numeric competencies. To do so, we took the average variance of discretionary spending of the two high expense variance rounds and the average variance of discretionary spending of the two low expense variance rounds, and created a new variable, which was the difference of the two values. We then regressed it on ONS, SNS, financial literacy, age, gender, years of education of household income. The final model is shown below.

Table 25. Linear regression results for Spending Variance between High and Low Expense Variance

	Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
	B		Beta		
(Constant)	10.22	20.54		0.498	0.619
ONS	3.63	1.93	0.14	1.88	0.061
SNS	-7.31	4.36	-0.12	-1.678	0.095

Note: Model R^2 = .023, df (1,209), F = 2.43 (p=0.091). Significant predictors are in bold for emphasis

Results indicated that ONS (B=3.627, p=0.061) and SNS (B=-7.309, p=0.095) were marginally significant predictors. This result suggested that the higher an individual was in ONS, the less smoothed out his or her investment would be when facing a high expense variance situation than facing a low expense variance one. Higher-ONS individuals appeared more sensitive to greater variability in expenses than lower-SNS individuals. Interestingly, results also

indicated that higher-SNS individuals appeared less sensitive to greater variability in expenses than lower-SNS individuals.

Discussions and Implications

In general, for the survey investment questions, we found many interesting results. First, higher vs. lower financial literacy was positively related to many investment traits, such as more active participation in investments, longer years of investment experience, preference for riskier investment options (i.e., stocks over bonds, stocks over treasury bills, stocks over bank savings), more likely to own retirement accounts and are more confident about their investment beliefs. Second, higher vs. lower SMAP surprisingly generated many negative correlations to traits, such as less investment participation, investing less in any investment composition, and being less likely to own retirement accounts. Thirdly, higher ONS was not predictive of many investment survey questions and was shown to be correlated to less risk preference in general. This could be due to the fact that our sample size greatly shrunk (N=124, reduced by 46%) during the survey portion of the investment questions. If a participant suggested that he or she had no experience in investing, all the follow-up question pertaining to investments were automatically skipped. This also applied to the retirement account related questions. Lastly, higher SNS was found to be positively correlated to risk taking in life in general, but was not related to risk taking in investments. Individuals with higher SNS were also shown to own a greater variety of investment composition.

For the retirement game, since more participants were involved and it reflected participant's investment behaviors from a more objective perspective, it yielded many other interesting findings. First, by replicating the game, we confirmed that participants tended to save

more when facing longer retirement and high expense variance than facing short retirement and low expense variance. Secondly, we found that participants with higher vs. lower financial literacy tended to have more savings at the retirement stage. When the two conditions, retirement length and expense variance were taken into consideration, participants with higher ONS saved more when facing a long retirement situation vs. a short retirement situation. Also, participants with higher ONS saved more when facing a high expense variance condition vs. a low expense variance condition. Thirdly, participants with higher ONS demonstrated a more smoothed spending pattern across all periods. The same change was discovered on participants' spending pattern when conditions shift. Participants with higher ONS tended to smooth out their spending more when facing a long retirement than facing a short retirement. Also, participants with higher ONS appeared to be more sensitive to greater variability in expenses than lower-ONS individuals.

Though to different levels, financial literacy, ONS, and SNS were found to be correlated to a variety of positive investment traits, demonstrably more so for financial literacy and objective numeracy. These results suggest that enhancing individuals' financial literacy and objective numeracy skills may improve investment behaviors and decisions. Since both abilities could be greatly enhanced by learning, it may yield interesting insights for future experimental studies.

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Appendices

	N	Minimum	Maximum	Mean	Std. Deviation
ONS	230	0	8	5.1	1.89
SNS	230	2.13	6	4.813	0.74
SMAP	230	-2.72	-1.08	-1.57	0.27
Financial literacy	230	1	10	6.85	2.06
Financial literacy no calculations	230	1	8	5.9	1.62
Investment Questions 1	230	1	6	3.72	1.25
Investment Questions 2	230	0	1	0.56	0.5
Investment Questions 3	127	1	6	3.87	1.14
Investment Questions 4	127	1	5	2.61	1.07
Investment Questions 5	128	0	1	0.77	0.43
Investment Questions 6	124	1	4	2.79	0.97
Investment Questions 7	125	1	4	1.92	0.85
Investment Questions 8	125	1	4	1.6	0.77
Investment Questions 9	125	1	4	2.2	0.87
Investment Questions 10	126	1	4	1.62	0.79
Investment Questions 11	230	0	1	0.38	0.49
Investment Questions 12	87	0	1	0.6	0.49
Investment Questions 13	87	0	1	0.77	0.42
Investment Questions 14	230	1	7	4.13	1.85
Investment Questions 15	230	0	1	0.68	0.47
Investment Questions 16	230	0	1	0.85	0.36
Age	230	19	67	34.6	9.34
Gender	230	0	1	0.64	0.48
Years of Education	228	2	26	15.24	2.83
Household income	230	1	7	3.66	1.65
Valid N (listwise)	62				

ONS

1.Imagine that we flip a fair coin 1,000 times. What is your best guess about how many times the coin would come up heads in 1,000 flips?

Answer:_____ times out of 1,000

2. In the BIG BUCKS LOTTERY, the chances of winning a $10.00 prize are 1%. What is your best guess about how many people would win a $10.00 prize if 1,000 people each buy a single ticket from BIG BUCKS?

Answer:_____ person(s) out of 1,000

3. In the ACME PUBLISHING SWEEPSTAKES, the chance of winning a car is 1 in 1,000. What percent of tickets of ACME PUBLISHING SWEEPSTAKES win a car?

Answer:_____%

4. If the chance of getting a disease is 10%, how many people would be expected to get the disease:

Out of 1000?

5. If the chance of getting a disease is 20 out of 100, this would be the same as having a ____% chance of getting the disease.

Answer: _____ %

6.Suppose your friend just had a mammogram. The doctor knows from previous studies that, of 100 women like her, 10 have tumors and 90 do not. Of the 10 who do have tumors, the mammogram correctly finds 9 with tumors and incorrectly says that 1 does not have a tumor. Of the 90 women without tumors, the mammogram correctly finds 80 without tumors and incorrectly says that 10 have tumors. The table below summarizes this information. Imagine that

your friend tests positive (as if she had a tumor), what is the likelihood that she actually has a tumor?

	Tested Positive	Tested Negative	Total
Actually Has a Tumor	9	1	10
Does Not Have a Tumor	10	80	90
Total	19	81	100

(Answer:_____ out of _____)

7.If John can drink one barrel of water in 6 days, and Mary can drink one barrel of water in 12 days, how long would it take them to drink one barrel of water together?

8. Jerry received both the 15th highest and the 15th lowest mark in the class. How many students are in the class?

SNS

1. How good are you at working with fractions?

Not at all good					Extremely good
1	2	3	4	5	6

2. How good are you at working with percentages?

Not at all good					Extremely good
1	2	3	4	5	6

3. How good are you at calculating a 15% tip?

Not at all good					Extremely good
1	2	3	4	5	6

4. How good are you at figuring out how much a shirt will cost if it's 25% off?

Not at all good					Extremely good
1	2	3	4	5	6

5. When reading the newspaper, how helpful do you find tables and graphs that are parts of a story?

Not at all helpful					Extremely helpful
1	2	3	4	5	6

6. When people tell you the chance of something happening, do you prefer that they use **words** ("it rarely happens") or **numbers** ("there's a 1% chance")?

Always prefer words					Always prefer numbers
1	2	3	4	5	6

7. When you hear a weather forecast, do you prefer predictions using **percentages** (e.g., "there will be a 20% chance of rain today") or predictions using only **words** (e.g., "there is a small chance of rain today")?

Always prefer words					Always prefer percentages
1	2	3	4	5	6

8. How **often** do you find numerical information to be useful?

Never					Very Often
1	2	3	4	5	6

SMAP

<u>Symbolic Number Mapping SMAP 22 item</u>

We are interested in your perception of numbers. On each of the following pages, we would like you to indicate how big the number shown is by marking its place on the number line.

1.Imagine that the line below runs from 0 to 1000. The left most point represents 0 and the right most point represents 1000.

Where does the number **5** belong on this line?

0 _____ 1,000

2.Imagine that the line below runs from 0 to 1000. The left most point represents 0 and the right most point represents 1000.

Where does the number **34** belong on this line?

0 _____ 1,000

3. Imagine that the line below runs from 0 to 1000. The left most point represents 0 and the right most point represents 1000.

Where does the number **78** belong on this line?

Please respond as quickly as possible.

0 _____ 1,000

4. Imagine that the line below runs from 0 to 1000. The left most point represents 0 and the right most point represents 1000.

Where does the number **122** belong on this line?

Please respond as quickly as possible.

0 _____ 1,000

5. Imagine that the line below runs from 0 to 1000. The left most point represents 0 and the right most point represents 1000.

Where does the number **163** belong on this line?

Please respond as quickly as possible.

0 _____ 1,000

6. Imagine that the line below runs from 0 to 1000. The left most point represents 0 and the right most point represents 1000.

Where does the number **246** belong on this line?

Please respond as quickly as possible.

0 _____ 1,000

7.Imagine that the line below runs from 0 to 1000. The left most point represents 0 and the right most point represents 1000.

Where does the number **486** belong on this line?

Please respond as quickly as possible.

0 _____ 1,000

8. Imagine that the line below runs from 0 to 1000. The left most point represents 0 and the right most point represents 1000.

Where does the number **722** belong on this line?

Please respond as quickly as possible.

0 _____ 1,000

9.Imagine that the line below runs from 0 to 1000. The left most point represents 0 and the right most point represents 1000.

Where does the number **754** belong on this line?

Please respond as quickly as possible.

0 _____ 1,000

10.Imagine that the line below runs from 0 to 1000. The left most point represents 0 and the right most point represents 1000.

Where does the number **818** belong on this line?

Please respond as quickly as possible.

0 _____ 1,000

11.Imagine that the line below runs from 0 to 1000. The left most point represents 0 and the right most point represents 1000.

Where does the number **938** belong on this line?

Please respond as quickly as possible.

0 _____ 1,000

Have you completed this line task before in other studies? If so, approximately how many times?

Financial Literacy Test

1. Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, would you be able to buy more than, exactly the same as, or less than today with the money in this account?

- More than
- Exactly the same
- Less than
- Do not know

2. Assume a friend inherits $10,000 today and his sibling inherits $10,000 but 3 years from now. Who is richer today because of the inheritance?
   - A friend
   - His sibling
   - Exactly the same
   - Do not know
3. If the interest rates rise, what should happen to bond prices?
   - Increase
   - Decrease
   - Remain the same
   - Do not know
4. Buy a company stock usually provides a sager return than a stock mutual fund.
   - True
   - False
5. Bonds are normally riskier than stocks.
   - True
   - False
6. Considering a long time period (for example 10 or 20 years), which asset described below normally gives the highest return: Savings accounts, Bonds, or Stocks?
   - Savings accounts
   - Bonds
   - Stocks
   - Exactly the same
7. When an investor spreads his money among different assets, does the risk of losing a lot of money increase, decrease or stay the same?
   - Increase
   - Decrease

- ○ Stay the same
- ○ Do not know

8. A stock mutual fund combines the money of many investors to buy a variety of stocks.
   - ○ True
   - ○ False
9. A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life will be less.
   - ○ True
   - ○ False

10. Suppose you owe $3,000 on your credit card. You pay a minimum payment of $30 each month. At an Annual Percentage Rate of 12% (or 1% per moth), how many years would it take to eliminate your credit card debt if you made no additional new charges?

    _____

Investment Behavior

1. How willing are you to take risks in your life, in general?

Not at all willing to take risks					Very likely to take risks
0	1	2	3	4	5

2. Do you invest?
   - ○ Yes
   - ○ No
3. When did you start investing?
   - ○ Less than a year ago
   - ○ About one to five years ago
   - ○ About six to ten years ago
   - ○ About eleven to twenty years ago
   - ○ More than twenty years ago
   - ○ Don’t know
4. How willing are you to take risks in your investments?

Not at all willing to take risks					Very likely to take risks
0	1	2	3	4	5

5. Please tell us who managed your investments in the last year. Please choose all that apply.
    a. I managed my investments myself
    b. Friends/Family members
    c. Professionals (such as a financial advisor or attorney)
    d. Other, please specify:

6. How much do you invest in stocks?
    - None in stocks
    - A little in stocks
    - About half in stocks
    - Mostly in stocks
    - Do not know

7. How much do you invest in bonds?
    - None in bonds
    - A little in bonds
    - About half in bonds
    - Mostly in bonds
    - Do not know

8. How much do you invest in government securities such as treasury bills?
    - None in government securities
    - A little in government securities
    - About half in government securities
    - Mostly in government securities
    - Do not know

9. How much do you invest in bank savings?

- None in bank savings
- A little in bank savings
- About half in bank savings
- Mostly in bank savings
- Do not know

10. Do you have a retirement account?
    - Yes
    - No

11. Have you ever tried to figure out how much you need to save for retirement?
    - Yes
    - No

12. In preparing for your retirement, please select all the people who you asked or plan to ask for financial advice.
    a. Didn't ask for advice
    b. Spouse/partner or other family member
    c. Banker or Financial advisor
    d. Friend
    e. Other, please specify:

13. If you purchased 1000 shares of stock from company A which you believed was a prominent and promising company, at the price of $100 per share, and a month later the price dropped to $50 per share, which of the following would you most likely do?
    - Sell all the shares
    - Sell some of the shares
    - Buy more shares
    - Do nothing

14. If you purchased 1000 shares of stock from company A which you believed was a prominent and promising company, at the price of $100 per share, and a month later the price increased to $150 per share, which of the following would you most likely do?
    - Sell all the shares
    - Sell some of the shares

- ○ Buy more shares
- ○ Do nothing

Demographics
In what state do you reside? _____

1. Your age: **_____**

2. Your gender: Female Male

3. Please indicate how many years of education you have completed:

Grade school																			Graduate school
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20+

4. What is your annual household income?

- ○ Under $15,000
- ○ $15,000 to $24,999
- ○ $25,000 to $34,999
- ○ $35,000 to $49,999
- ○ $50,000 to $74,999
- ○ $75,000 or more
- ○ Decline to respond

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